The C.W. Brabender® „3-Phase-System“

Tools for Quality Control, Research and Development

Dr. Jens Dreisoerner, Head of Food Laboratory

Brabender® GmbH & Co.KG Duisburg - Germany

…where quality is measured.

Content

1923 C.W. Brabender® Elektromaschinen,
founded by Carl Wilhelm Brabender, Duisburg

2012 The Brabender® group today

- Brabender® GmbH & Co. KG Duisburg, Germany
  ⇒ Laboratory equipment for food and plastic industry
- Brabender® GmbH & Co. KG Moscow, Russia
  ⇒ Responsible for Russia and former USSR countries
- C.W.Brabender® Instruments Inc. (New Jersey, USA)
  ⇒ Responsible for the markets in America
- Brabender® Technologie KG, Duisburg
  ⇒ Feeders, and flow meters for bulk solids
- Brabender® Messtechnik® GmbH & Co. KG Duisburg
  ⇒ Aquatrac, Instruments for the plastic industry

The C.W. Brabender® 3-Phase-System

1. History of Brabender®

- Research and Development
- Brabender®-Group with about 400 employees
- 116 agencies in more than 110 countries worldwide
- Over 17 years constantly certified DIN EN ISO 9001

Duisburg, Germany

…where quality is measured.

Brabender®

The Brabender® 3-Phase-System

1. History of Brabender®

Brabender®

Food Sector

- Milling Industry
- Baking Industry
- Starch Industry
- Others (Confectionery, Yeast Industry)
- Extrusion
- R & D

Chemical Sector

- Polymer and rubber Industry
- Pharma Industry
- Chemical Industry
- Quality Assurance
- R & D

…where quality is measured.

Brabender®

Food: Application laboratory

1930

2012

Training, sample testing, new developments, research, cooperations…

…where quality is measured.

The Brabender® 3-Phase-System

2. From grain to bread

Over 30 instruments for standard and customer specified tests available,…

Mills

Moisture

NIR

Mixing

Stretching

Gelling

…where quality is measured.

Brabender®

Laboratory instruments - examples

Sample Preparation

- Cleaning
- Separation
- Milling

Quadrumat® Junior

Moisture Content

- Determination of water content

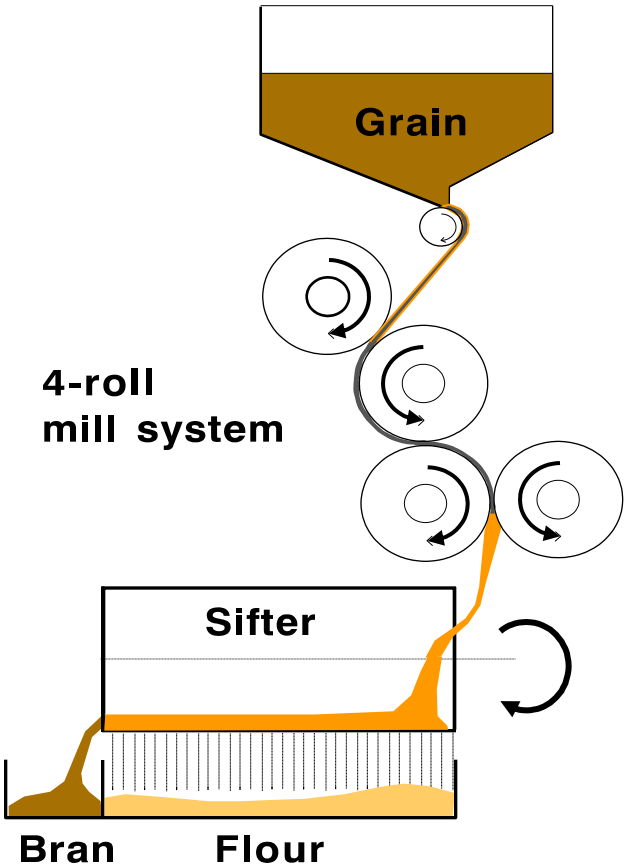
Moisture Tester MT-C

The Brabender® 3-Phase-System

2. From grain to bread – Sample preparation

Automatic multi-step grinding process with 4-roll milling system and one round sifter.

Quadrumat® Junior



AACC 26-50

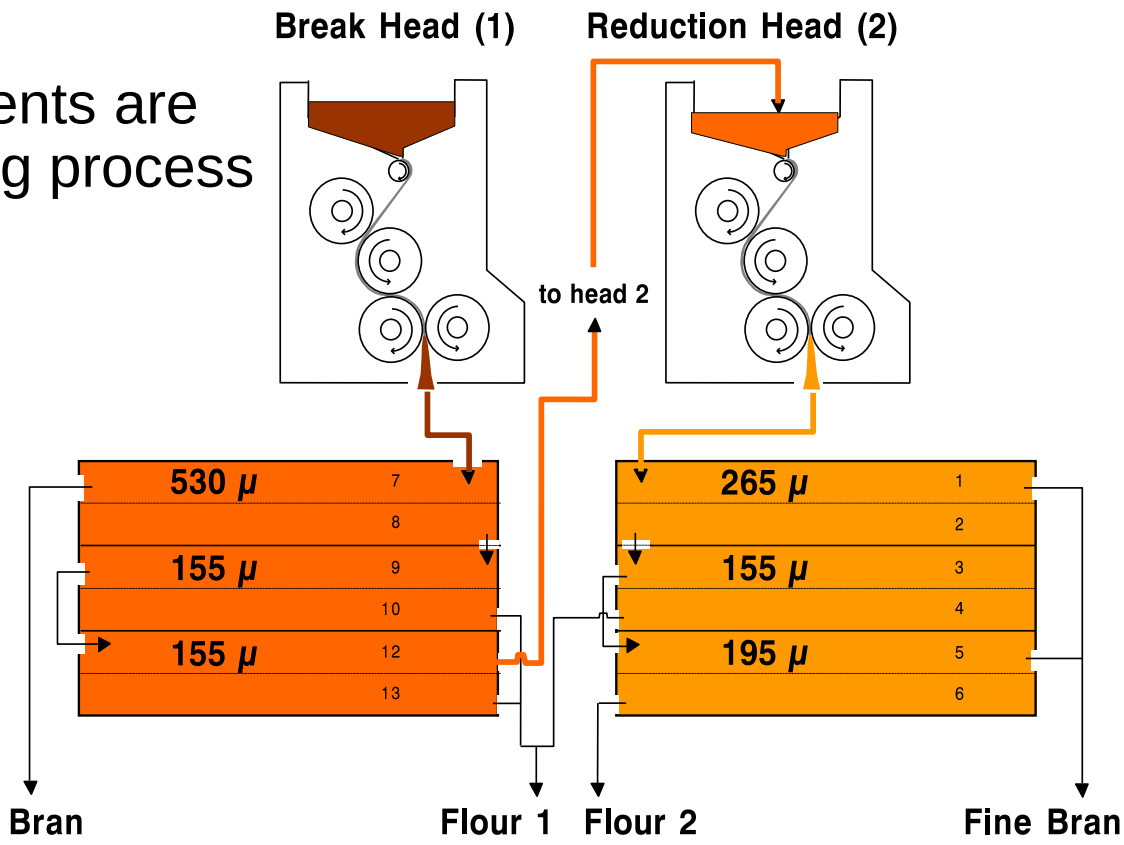
…where quality is measured.

Brabender®

The Brabender® 3-Phase-System

2. From grain to bread – Sample preparation

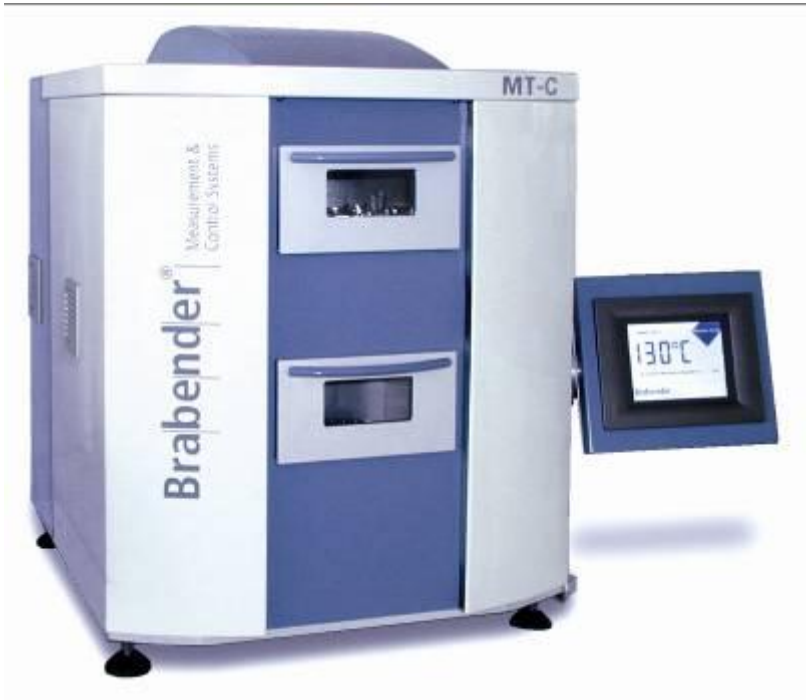
Five different sifter arrangements are possible to simulate the milling process in the millhouse



Quadrumat® Senior

BIPEA BY 102.D.9302

Brabender® Rapid Moisture Tester MT-C



Whole meal

Flours, bran, tobacco…..

10 samples capacity

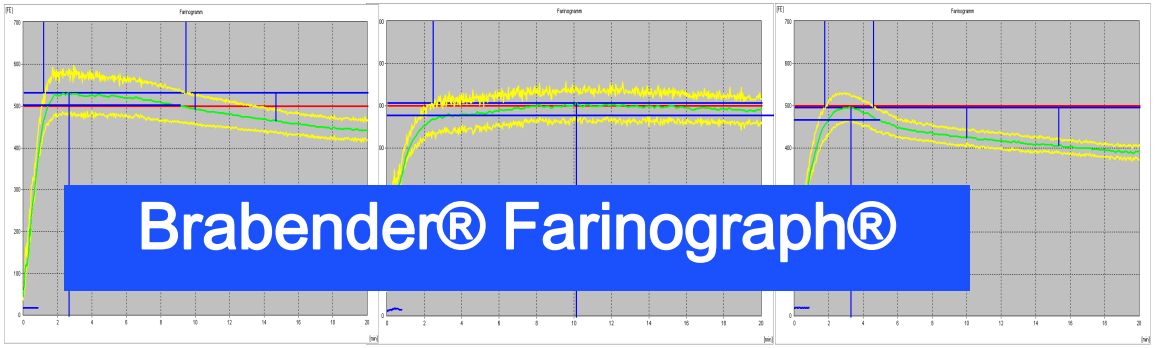
ICC 110/1, ISO 712. VO[EU] 2182/2005

…where quality is measured.

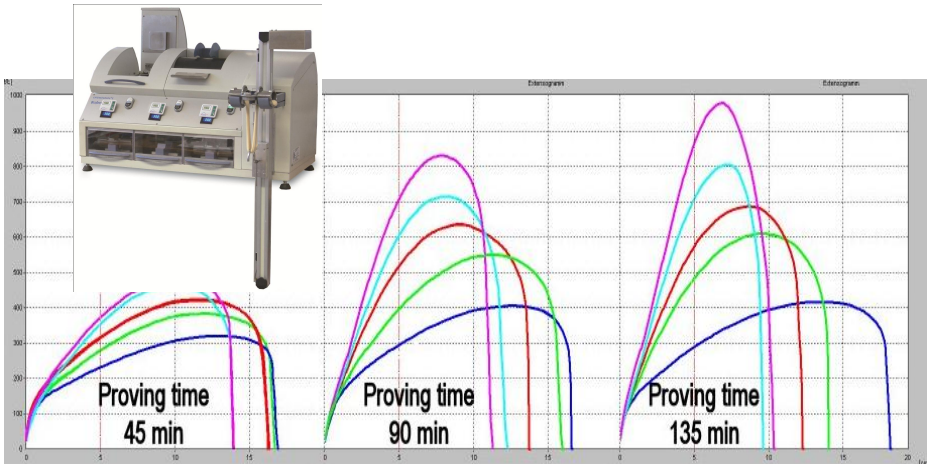
Brabender®

The C.W. Brabender® 3-Phase-System

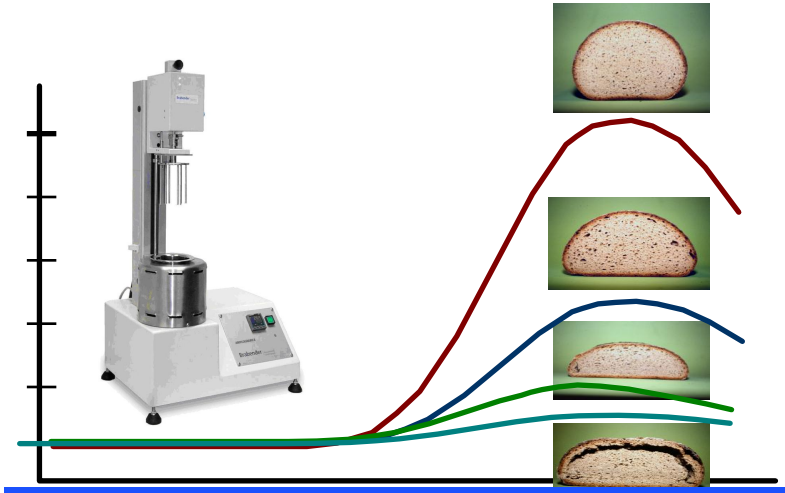
3. C.W.Brabenders vision: The 3 phase system



Brabender® Farinograph®



Brabender® Extensograph®



Brabender® Amylograph®

Brabender®

Raw materials

- Composition (protein, moisture, ash, fat,…)
- Properties of ingredients
- Final: Quality of flour
- Technology used, process needes certain flour

⇒International Brabender® standards have been developed, are well defiened and used worldwide over decades.

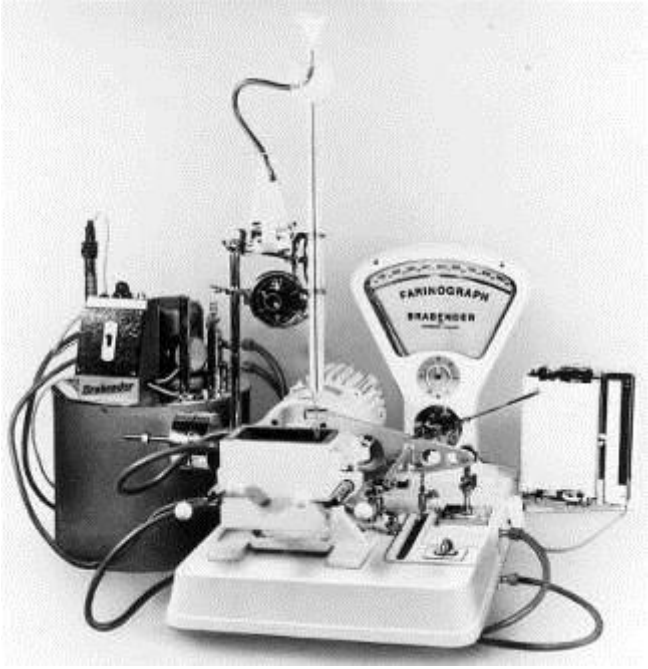
Standards are needed, to compare sample quality, „to speak the same language“ same procedures must be used.

The C.W. Brabender® 3-Phase-System

4. Brabender® Farinograph®: Phase 1: Dough mixing

1928 The first Farinograph® was built

First wheat flour dough mixing instrument worldwide



84 years on the market - worldwide

…where quality is measured.

Brabender®

The following standards are used over decades worldwide:

- AACC method 54-21
- ICC standard 115/1
- ISO 5530-1

Important

The only instrument which meets these international standards is the Brabender® Farinograph®

2012 Today: Farinograph® AT

Farinograph® AT

Integrated dosage unit

…where quality is measured.

Brabender®

Phase 1: Dough mixing

Key question: Water absorbtion and how stable is the dough during mixing?

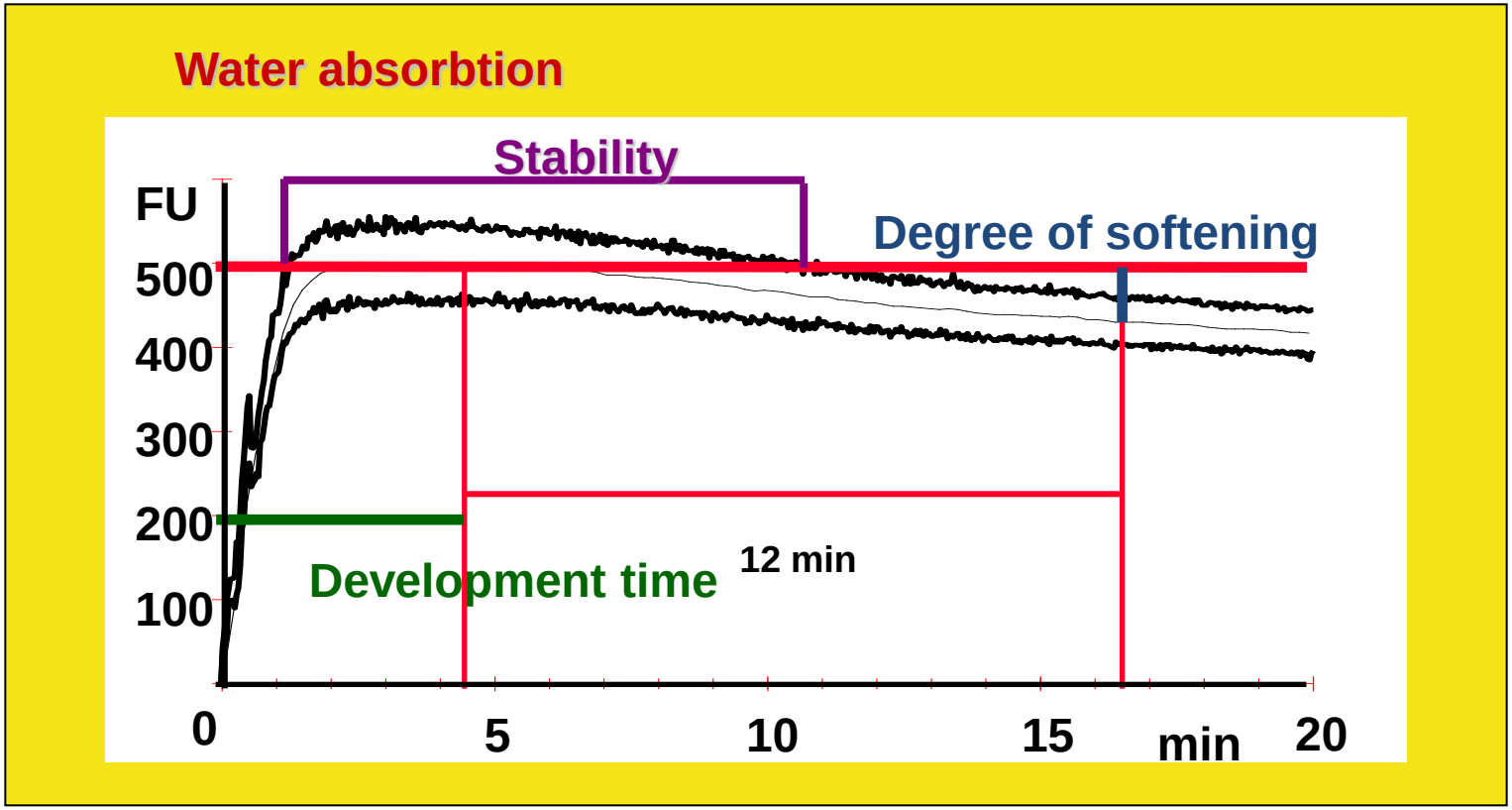
- Water absorbtion
- Protein quality
- Enzyme activity (Proteases)
- Mixing stabilty

Farinograph® AT

AACC standard 54.-21, ICC standard 115/1, ISO 5530-1, 5530-2, …

…where quality is measured.

Example: Evaluation ICC 115/1 Farinograph®

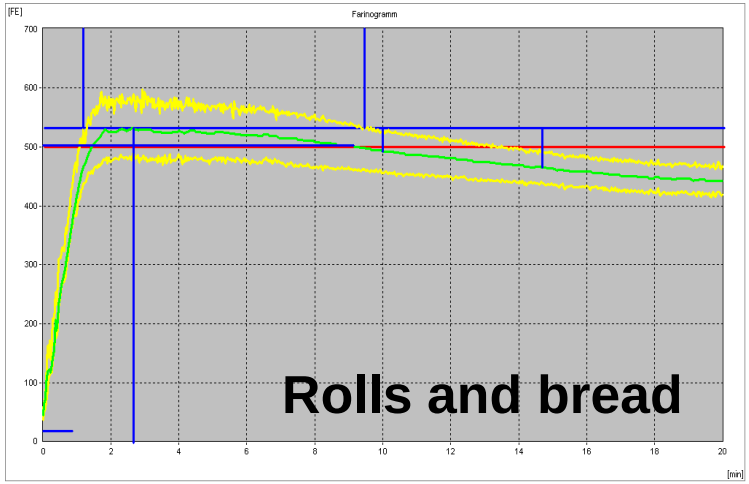


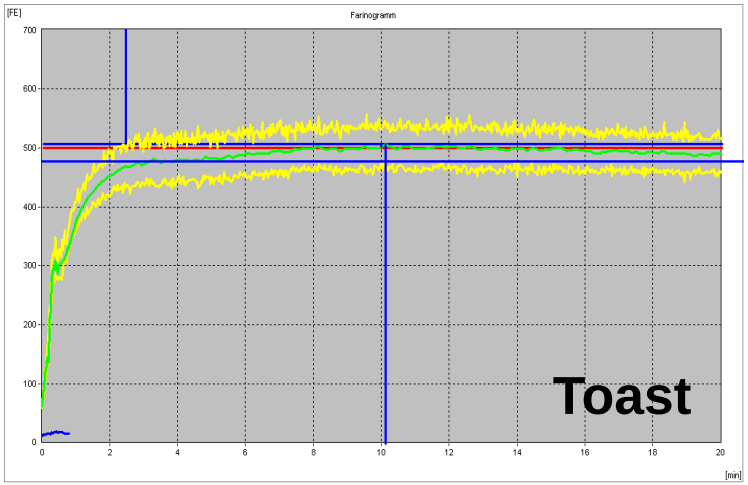
…where quality is measured.

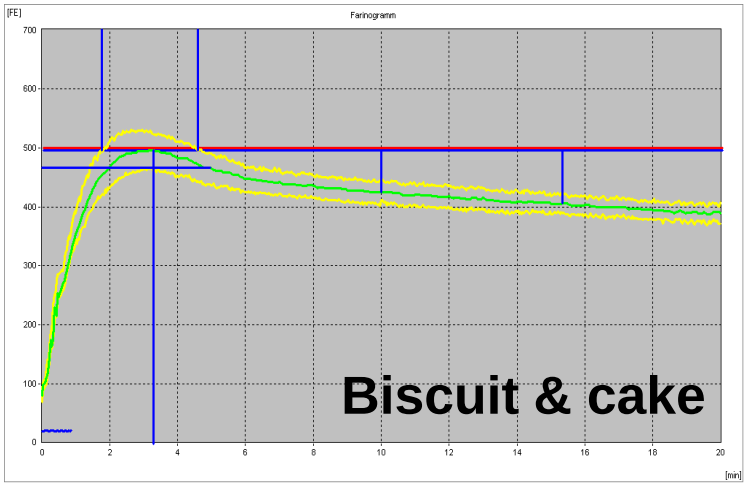
The C.W. Brabender® 3-Phase-System

4. Brabender® Farinograph®: Phase 1: Dough mixing

Examples of flours







Evaluation of results

	Weak flour	Strong flour
Water absorption [%]	54 - 58	58 – 67
Dough development time [min]	< 2,5	2,5 – 14,0
Dough stability [min]	< 3,0	> 10
Degree of softening [FU]	> 80	< 80

Usual standard mixers@ Farinograph®

Sigma mixer S 300 and S 50

- Standard test
- 300 or 50 g flour

Sigma mixer S 10

- For small samples
- 10 g flour

Hardness and Structure Tester

- Hardness of grain (wheat, **maize/corn,** barley, malt)

The C.W. Brabender® 3-Phase-System

4. Brabender® Farinograph®: Phase 1: Dough mixing

1. Standard software to run international standard test like ICC, AACC or others

2. Additional software options beside the standard Farinograph® test (examples)

- Correlation software
- Variable speed (0-200 min^{-1})
- Create own speed profiles (Speed/times)
- Create own temperature profiles
- Create own evaluations/methods
- LIMS – Lab Data management system

NEW

The C.W. Brabender® 3-Phase-System

5. Brabender® Extensograph®:Phase 2: Dough resting and change of elasticity

Extensograph®

1972

Extensograph®-E

2012

…where quality is measured.

Brabender®

The following standards are used over decades worldwide:

- AACC method 54-10
- ICC standard 114/1
- ISO 5530-2

Important

The only instrument which meets these international standards is the Brabender® Extensograph®

The C.W. Brabender® 3-Phase-System

5. Brabender® Extensograph®:Phase 2: Dough resting and change of elasticity

Dough homogenizer

Roll / cylinder former

Proving cabinets

Streching device

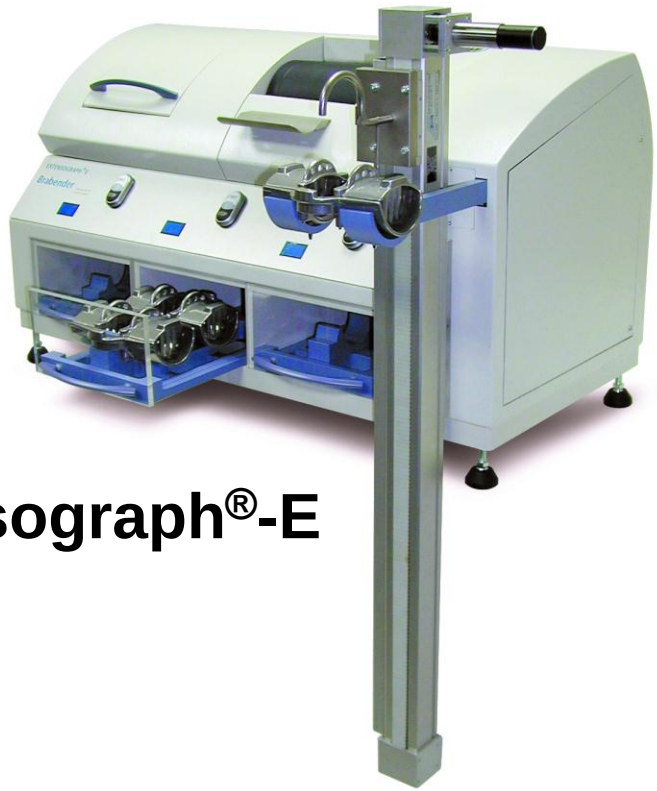
…where quality is measured.

Brabender®

Phase 2: Dough resting and stretching

Key question: Can the dough hold gas?

- Wheat: Time pending quality (time!)
- Dough properties/elasticity (time!)
- Enzymes, Baking properties (time!)



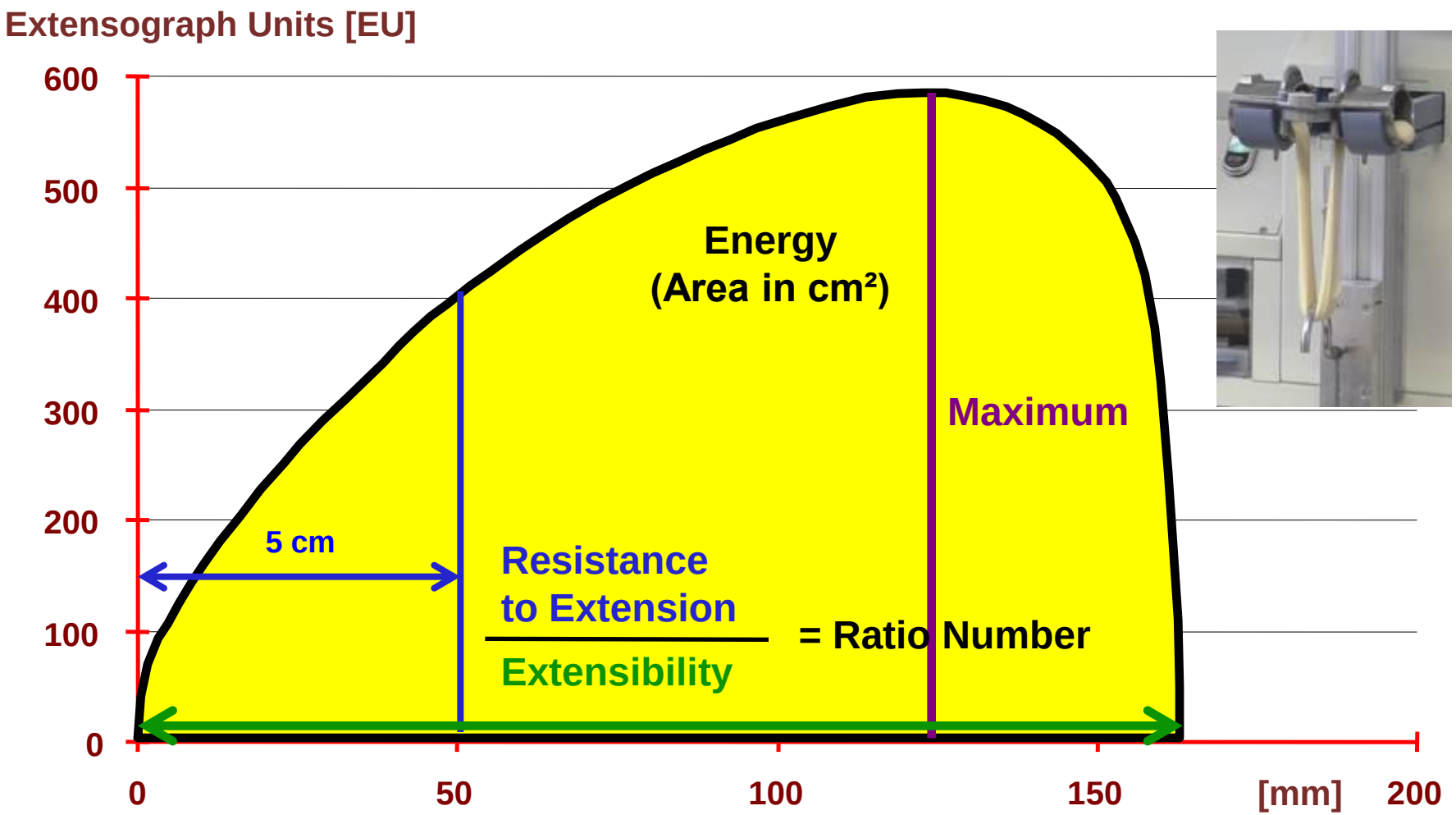
Extensograph®-E

AACC standard 54-10, ICC standard 114, ISO 5530-2, …

…where quality is measured.

The C.W. Brabender® 3-Phase-System

5. Brabender® Extensograph®:Phase 2: Dough resting and change of elasticity



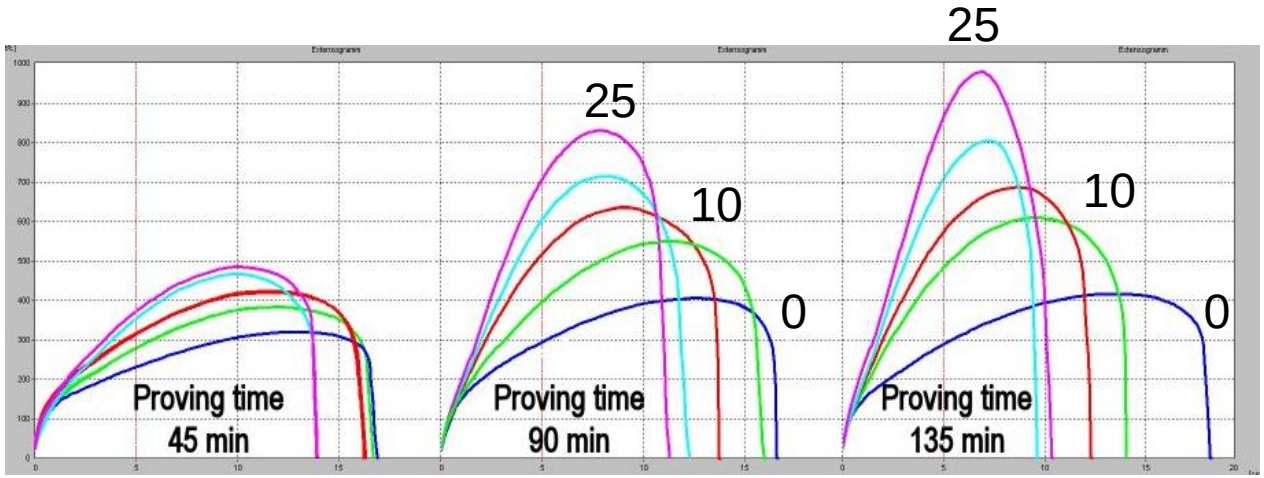
…where quality is measured.

Brabender®

Influences of additives – 5 concentrations

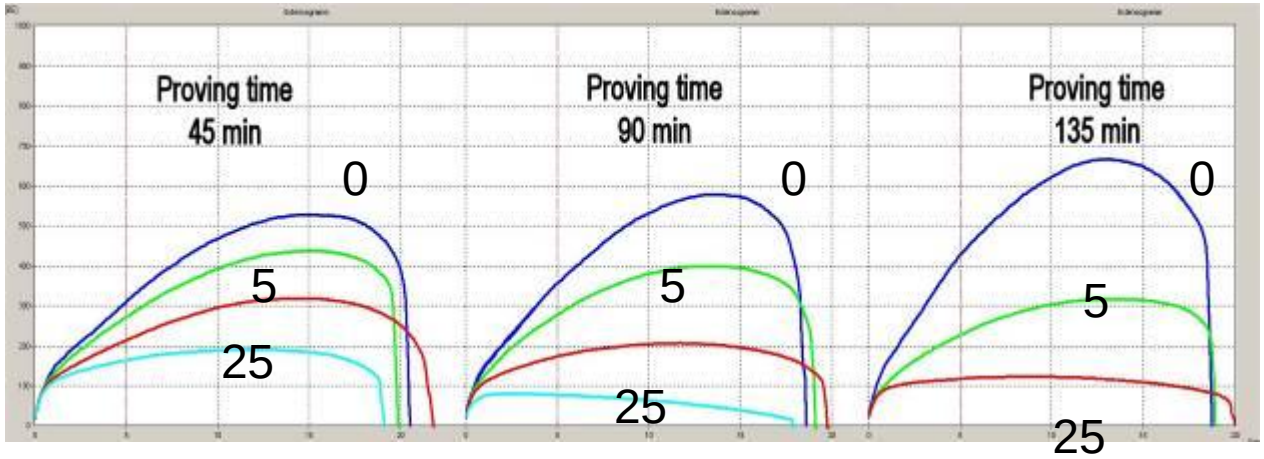
Ascorbic acid

- 25ppm addition
- 10ppm addition
- no addition



Proteinase

- no addition
- 5 ppm addition
- 25ppm addition



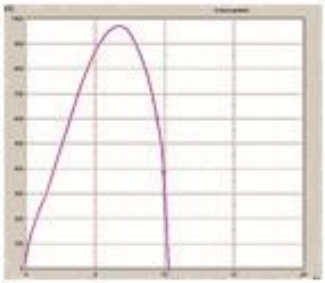
…where quality is measured.

Evaluation of Extensograph® results

	Weak flour	Strong flour	Rigid, tough dough
Energy [cm²]	< 100	110-130	120-140
Resistance to Extension [EU]	< 300	400-600	> 600
Extensibility [cm]	100-130	130-160	< 120
Extension maximum[EU]	150-400	500-700	> 700
Ratio number	< 2,5	3,0-4,5	> 5,0

The C.W. Brabender® 3-Phase-System

5. Brabender® Extensograph®:Phase 2: Dough resting and change of elasticity



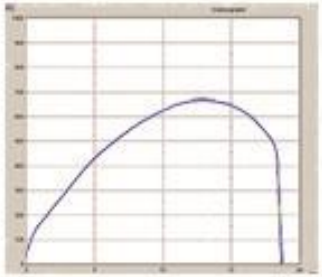
tough

> 800 EU

- Short, hard gluten
- The fermentation gas of the yeast could not extend the dough

= Small pieces of bread with poor dough spring and hard crump

---



extansible, elastic

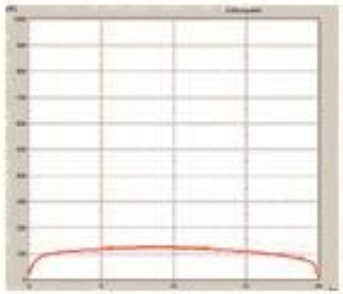
500-600 EU

- Extensible, elastic gluten
- The fermentation gas of the yeast could extend the dough

= baking products with a good, nice volume and soft crump

The C.W. Brabender® 3-Phase-System

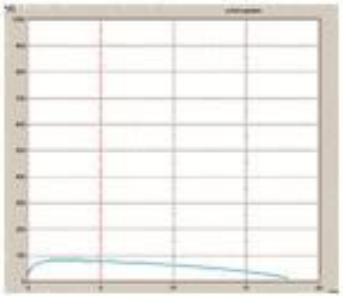
5. Brabender® Extensograph®:Phase 2: Dough resting and change of elasticity



elastic

200-400 EU

- Soft and weak gluten
- The dough could not keep the fermentation gas very well
- low baking volume, but good for puff pasty !



wet

< 100 EU

- Very weak gluten

= not suitable for normal baking products, maybe cookies

Phase 3: Gelling of starch

Key question: Can the starch absorb the water during baking?

- Enzyme activity (Amylases)
- Gelling behaviour of starch
- „Video“ of starch gelling, not just picture

Amylograph®-E

AACC standard 61-01, ICC standard 169

Standardized ICC/AACC/ISO Method:

A slurry of flour and water is heated by the instrument .

The viscosity of the sample is measured during the heating process.

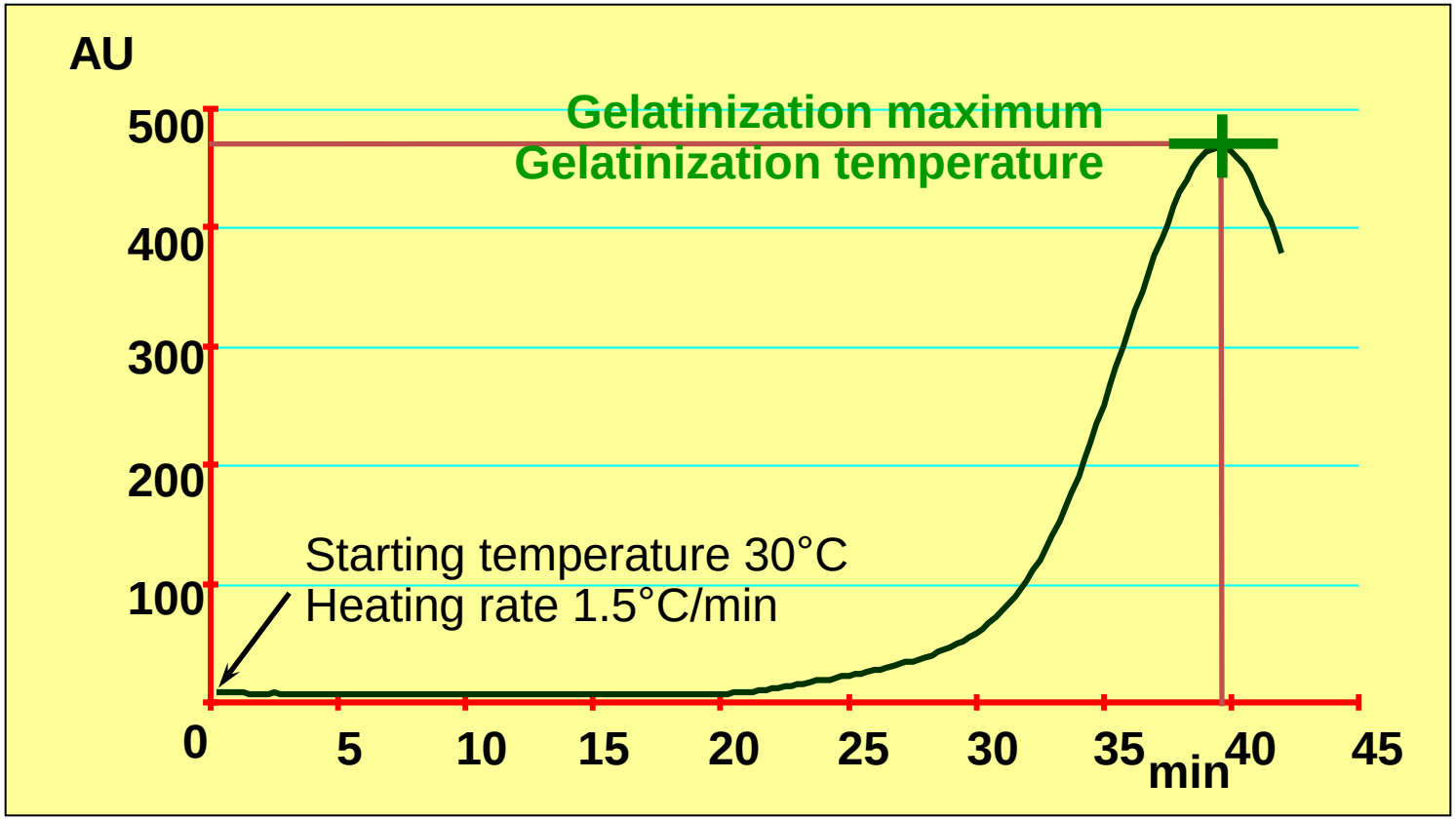
An online diagram of viscosity versus time (temperature) is recorded.

The real temperature is always measured **inside** the sample.

The C.W. Brabender® 3-Phase-System

6. Brabender® Amylograph®: Phase 3: Starch gelling / amylase activities

Evaluation Amylograph test



…where quality is measured.

Standardized ICC/AACC/ISO Method:

Enzyme activity (Alpha-Amylase)

During baking, the protein releases water. This water needs to be bound.

Starch in „good“ conditions can absorb water during the heating/gelatinization process.

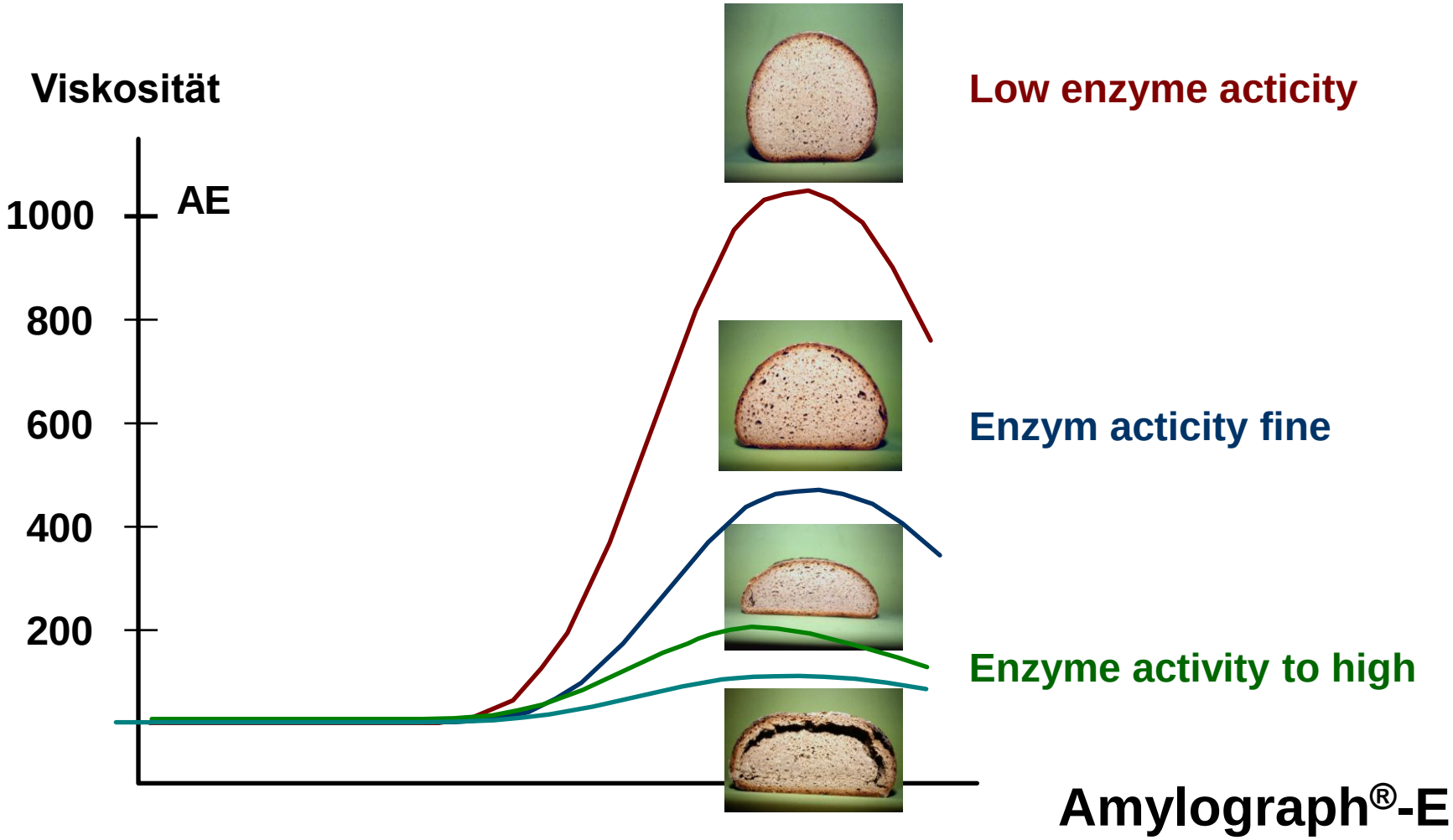
If enzymes are breaking the starch molecules too much, the water is more or less freeand cannot be bound by the starch.

The crump of the bread may collapse (worst case), be wet and be of poor chewing properties.

A well balanced amylase activity is needed.

The C.W. Brabender® 3-Phase-System

6. Brabender® Amylograph®: Phase 3: Starch gelling / amylase activities



…where quality is measured.

1960 First AACC Methods

Amylograph

Extensograph®

Farinograph®

Enzymes

AACC Method **22-10**
Page 1 of 2

DIASTATIC ACTIVITY OF FLOUR, WITH THE AMYLOGRAPH

Final approval 5-5-60; revised 10-27-82; reviewed 10-26-94

Definition

The amylograph is a recording viscometer that may be used primarily to determine the effect of α-amylase on the viscosity of flour as a function of temperature. The high viscosity of the starch gel is counteracted by the action of α-amylase, which liquefies starch granules during heating of slurry. The amylograph value, or malt index, provides information on the probable effect of malt α-amylase during the baking process.

Apparatus

Brabender amylograph; obtainable from C. W. Brabender Co., 50 E. Wesley St., South Hackensack, NJ 07606, and Brabender OHG, Duisburg, Germany.

Standard methods applied worldwide

- **AACC methods**

American Association of Cereal Chemists; USA

- **ICC standards**

International Association for Cereal Chemistry; Austria

- **ISO**

International Organization for Standardization; Switzerland

- **National standards**

CEN/DIN/, IRAM-Argentina / RACI-Australia / FTWG-Great Britain, GB/China

…..

The following standards are decisive for worldwide and cross-border trade:

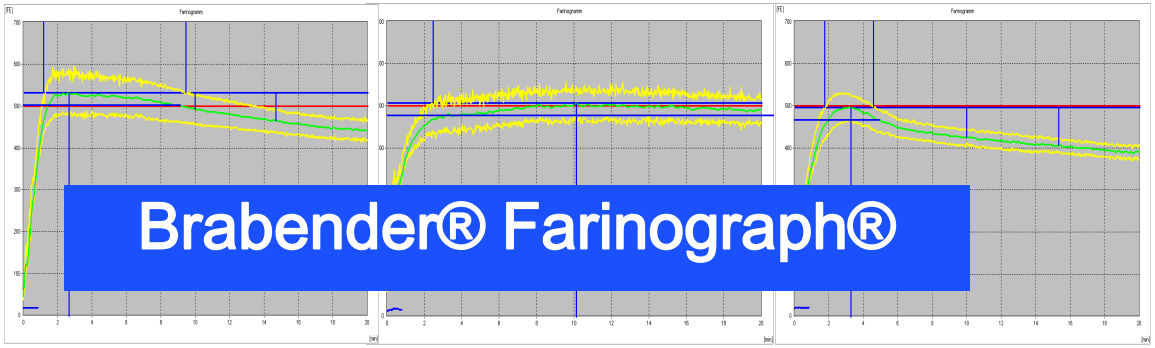
- AACC method 61-01
- ICC standard 169

Important

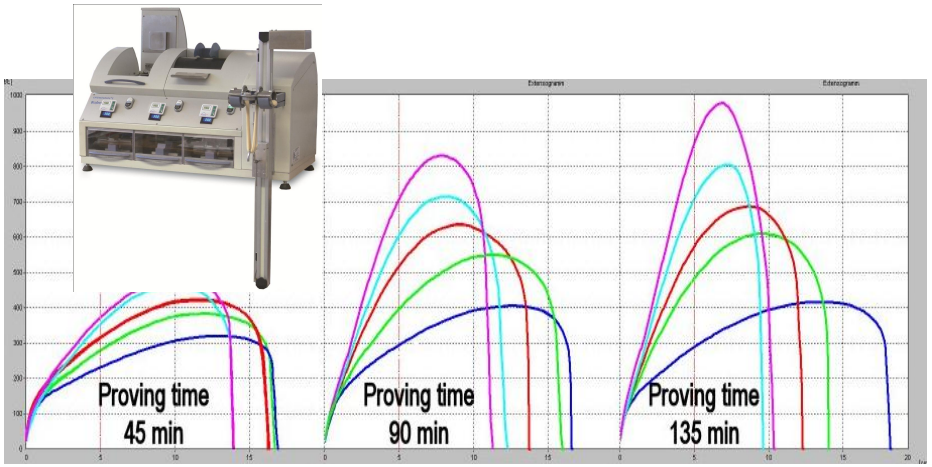
The only instrument which can meet these international regulations is the Brabender® Amylograph®

The C.W. Brabender® 3-Phase-System

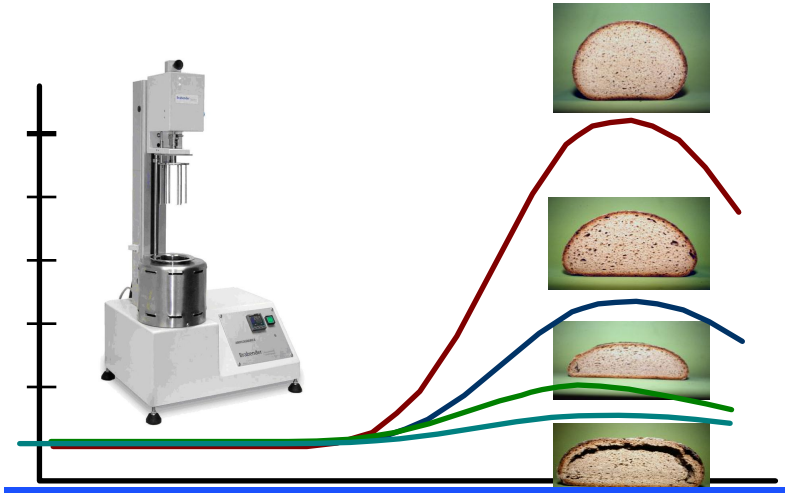
3. C.W.Brabenders vision: The 3 phase system



Brabender® Farinograph®



Brabender® Extensograph®



Brabender® Amylograph®

Brabender®

The C.W. Brabender® 3-Phase-System

7. Conclusions

- Optimization /standardization of flour quality requires standard procedures and high quality instruments
- With the 3 phase system flour can be well defiened
- Constant and good flour quality reduces waste in bakeries
- Optimizations of technological processes are possible
- Optimum and constant baking quality can be achieved

The C.W. Brabender® 3-Phase-System
7. Conclusions

- Benefit for the user:
  - ✓ Mill: Constant and better quality, higher flour price possible
  - ✓ Bakery: Constant quality in products, higher market share
  - ✓ Bakery: More baked goods by choosing better flours

Thanks for your attention

…where quality is measured.

Brabender®